What is claimed is:

~~CLAIMS~~

1. A process for forming a phosphate conversion coating on a metal substrate surface, said process comprising the following operations:

(I) contacting the metal substrate surface with an aqueous liquid surface conditioning composition that comprises, preferably consists essentially of, or more preferably consists of, water and the following components:

(I.A) dispersed solid phosphate particles that:

(i) have a diameter no greater than 5 μm; and

(ii) comprise at least one substance selected from the group consisting of phosphates that contain at least one type of divalent or trivalent metal cations;

and

(I.B) as adhesion-promoting component, at least one selection from the group consisting of the following subgroups:

(1) monosaccharides, polysaccharides, and derivatives thereof;

(2) phosphorus containing solutes selected from the group consisting of orthophosphoric acid, condensed phosphoric acids, and organophosphonic acid compounds;

(3) water-soluble polymers that are homopolymers or copolymers of vinyl acetate and derivatives of these homopolymers and copolymers; and

(4) copolymers and polymers afforded by the polymerization of:

(a) at least one selection from:

-- monomers, exclusive of vinyl acetate, that conform to general chemical formula (I):

$$H_2C=C(R^1)-COOR^2 \quad (I),$$

where R^1 = H or CH_3 and R^2 = H, C_1 to C_5 alkyl, or C_1 to C_5 hydroxyalkyl; and

-- other α,β-unsaturated carboxylic acid monomers; and, optionally,

(b) not more than 50 % by weight of monomers that are not vinyl acetate and are not within the description of part (a) immediately above but are copolymerizable with said monomers that are

within the description of said part (a);

and

(II) contacting the metal substrate surface as conditioned in operation (I) as described above with a nickel-free phosphate conversion treatment bath that comprises water and the following amounts of the following components:

(II.A) from 0.5 to 5 g/l of zinc cations;

(II.B) from 5 to 30 g/l of phosphate ions; and

(II.C) a component of conversion accelerator.

2. A process according to claim 1, wherein the phosphate conversion treatment bath also contains from 0.1 to 3.0 g/l of at least one type of ions selected from the group consisting of magnesium ions, cobalt ions, manganese ions, calcium ions, tungstate ions, and strontium ions.

3. A process according to claim 2, wherein the concentration of component (I.A) is from 0.001 to 30 g/l and the concentration of component (I.B) is from 1 to 2,000 ppm.

4. A process according to claim 1, wherein the concentration of component (I.A) is from 0.001 to 30 g/l and the concentration of component (I.B) is from 1 to 2,000 ppm.